## REMARKS

Applicants thank the Examiner for thoroughly reviewing the application.

### Objections to the Disclosure

Applicant has complied (except as noted below) with the Examiner's suggested amendments to the specification, thereby remedying those objections.

Applicant has removed undiscussed reference numerals from the figures, thereby remedying those objections.

Applicant has added inadvertently omitted reference numerals to the figures, thereby remedying those objections.

With regard to Examiner's suggestion that "Figure 5" on page 8, line 5, should read "Figure 5(b)," Applicant asserts that this text should read "Figure 5(a)", instead. Applicant points out that the circuit is depicted in Figure 5(a), not Figure 5(b). Therefore, the specification has been amended to read "Figure 5(a)."

With regard to Examiner's suggestion that "Figure 6" on page 8, line 6, should read "Figure 6(b)," Applicant asserts that this text should read "Figure 6(a)", instead. Applicant points out that the circuit is depicted in Figure 6(a), not Figure 6(b). Therefore, the specification has been amended to read "Figure 6(a)."

With regard to Examiner's suggestion that the symbols "+" and "-" be removed from Figures 3 and 4, Applicant asserts that these symbols are not reference numerals, and therefore need not be removed. These symbols indicate the polarity of voltages V (Figure 3), $V_1$ (Figure 4), and $V_2$ (Figure 4). Each of the voltages are discussed in the specification. No amendment of these figures has been made. Applicant respectfully requests reconsideration and withdrawal of this objection.

With respect to Examiner's objection regarding failure to describe reference numeral 930, Applicant asserts that this reference numeral is, in fact, used in the specification. Applicant respectfully turns the Examiner's attention to page 9, line 8. Applicant respectfully requests reconsideration and withdrawal of this objection.

With respect to Examiner's objection regarding failure to describe reference numeral 1000, Applicant asserts that this reference numeral is, in fact, used in the

specification. Applicant respectfully turns the Examiner's attention to page 9, line 3. Applicant respectfully requests reconsideration and withdrawal of this objection.

Objections To Incorporation By Reference

With regard to the objection to incorporation by reference of a foreign patent application, patent, or publication, Applicant asserts that no such incorporation has been made. Applicant asserts that the only incorporated documents are United States Patent Application Nos. 08/706974, 09/040578, and 09/699783 (none of these are foreign documents). Applicant respectfully requests withdrawal of this objection.

The incorporation by reference of United States Application Nos. 08/706974, 09/040578, and 09/699783 has been objected to because it has not yet been established whether all three applications will either publish or issue as a patent. Applicant points out that Application No. 08/706974 has issued as United States Patent No. 6,438,394. The other two applications remain pending. Applicant will amend the disclosure of this application to include the text of Application Nos. 09/040578 and 09/699783, if necessary, upon allowance of the claims. See MPEP §608.01(p).

Rejection of the Claims Under 35 U.S.C. §112, Second Paragraph

Applicants have complied with the Examiner's recommended amendments, with two exceptions (discussed below). Applicants note that these amendments were made in response to formal matters and not to overcome prior art. Accordingly, these amendments should not be construed in a limiting way.

Claim 5 reads: "5. The circuit as set forth in claim 1, wherein the closed conductive loop is at least partially formed on a layer of dielectric material." The Examiner has stated that the phrase ". . . is at least partially formed" is inadequate to convey the full scope of claim coverage. Applicant is uncertain what hypothetical meaning the Examiner believes may or may not be encompassed by such wording. Applicant asserts that the meaning of "is at least partially formed" is that, at minimum, a portion of the conductive loop is formed on a layer of dielectric material. Applicant

respectfully asserts that this is the ordinary meaning of such language. Accordingly, Applicant respectfully requests reconsideration and withdrawal of this rejection.

Claims 12 and 13 were rejected as being improper dependent claims because they added subject matter that made the claims more comprehensive. Applicant respectfully points out that the test for whether a dependent claim is proper is "that [a dependent claim] shall include every limitation of the claim from which it depends (35 U.S.C. 112, fourth paragraph) or in other words that [a dependent claim] shall not conceivably be infringed by anything which would not also infringe the basic claim." MPEP §608.01(n). Applicant points out that claims 12 and 13 meet this test, and should be considered proper. Applicant further points out that "a dependent claim does not lack compliance with 35 U.S.C. 112, fourth paragraph, simply because there is a question as to . . . whether the further limitation in fact changes the scope of the dependent claim from that of the claims from which it depends." Id. Thus, that the added subject matter of claims 12 and 13 makes the claims more comprehensive is not a factor to be considered. For the foregoing reasons, Applicant respectfully requests reconsideration and withdrawal of the rejection of claim 12 and 13.

Rejection of Claims 1, 3-5, and 6 Under 35 U.S.C. §102(b)

Claims 1, 3-5, and 6 were rejected under 35 U.S.C. §102(b) as being anticipated by United States Patent Number 5,381,117 (Okamura). Applicants respectfully traverse this rejection.

According to the Office Action, Okamura teaches a "shunt capacitor comprising a closed conductive loop," as required by independent claim 1. The Office Action identifies Figure 19 of Okamura as disclosing such a shunt capacitor. Figure 19 of Okamura depicts a resonator structure having an input/output terminal (denoted be reference numeral 7) and an earth terminal (denoted by reference numeral 6). The earth terminal (6) attaches to an external earth electrode (reference numeral 9, shown in Figure 2), which, in turn, attaches to an earth terminal pattern (reference numeral 8, shown in Figure 2). Thus, earth terminal 6 is grounded.

Applicants point out that a shunt capacitor is a device that exhibits a capacitor-like impedance between a transmission line and ground. The structure taught by Okamura does not exhibit a capacitor-like impedance to ground, because one of its terminals is grounded. This structure would short out a transmission line—not exhibit a capacitor-like impedance between the transmission line and ground. Thus, because the earth terminal (6) of Figure 19 is grounded, the structure taught by Figure 19 does not function as a shunt capacitor at all.

In short, Okamura fails to teach a "shunt capacitor comprising a closed conductive loop." Instead, because of earth terminal (6) being grounded, Okamura teaches a *resonator* comprising a closed conductive loop—not a *shunt capacitor* comprising a conductive loop.

Because Okamura fails to teach a shunt capacitor comprising a conductive loop, Okamura cannot serve as a proper basis for rejection of claims 1, 3-5, and 6. Therefore, Applicant respectfully requests reconsideration and withdrawal of the rejection of claims 1, 3-5, and 6 under 35 U.S.C. §102(b).

Rejections Under 35 U.S.C. §103(a)

Claims 7-10 and 12-16 were rejected under 35 U.S.C. §103(a), as being obvious in light of Okamura in view of either Takahashi or Schmidt. Applicant points out that these rejections rely upon the proposition that Okamura teaches a "shunt capacitor comprising a closed conductive loop." As discussed above, this is not the case.

To make out a *prima facie* case of obviousness under 35 U.S.C. § 103(a), there must exist some motivation, either generally available to one of ordinary skill in the art or expressly stated in the prior art, to modify the known prior art to arrive at the claimed invention. No motivation has been stated to modify Okamura (or Schmidt or Takahashi) to include "shunt capacitor comprising a closed conductive loop." Further, no such motivation is articulated within any of those references themselves. Thus, Okamura, Takahashi, and Schmidt are unable to support a rejection, either alone or in concert, under 35 U.S.C. §103(a). For the foregoing reason, Applicants respectfully

request that the Examiner withdraw the rejection of claims 7-10 and 12-16 under 35 U.S.C. §103(a).

## Conclusion

Claims 1-18 remain pending in the application. These claims are believed to be allowable for the reasons set forth above. This amendment is believed to be responsive to all points raised in the Office Action. Accordingly, Applicants respectfully request prompt reconsideration, allowance, and passage of the application to issue. Should the Examiner have any remaining questions or concerns, the Examiner is urged to contact the undersigned by telephone at the number below to expeditiously resolve such concerns.

Respectfully submitted,

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Dated: 19 Dec. 2002

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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| Applicant: | Shen Ye | Examiner: | Lee, Benny T |
| Serial No.: | 09/814,271 | Group Art Unit: | 2817 |
| Filed: | March 21, 2001 | Docket No.: | 10467.51-US-01 |
| Title: | DEVICE APPROXIMATING A SHUNT CAPACITOR FOR MICROWAVE FILTERS | | |

## SPECIFICATION AMENDMENTS—MARKUP

### Fourth full paragraph of page 3:

Figures 1(a)[-(d)], 1(b), 1(c) and 1(d) show shunt capacitors using microstrip metal patches.

### Eighth full paragraph of page 3:

Figures 7(a) and 7(b) show, respectively, a circuit similar to that shown in Figure 6(a) but with a single-ended open stub **[730]** in place of the closed loops **[630]** in Figure 6(a), and the simulated frequency response for the circuit in Figure 7(a).

### Ninth full paragraph of page 3:

Figures 8(a) and 8(b) show, respectively, a circuit similar to that shown in Figure 6(a) but with double-ended open stubs **[830, 850]** in places of the closed loops **[630]** in Figure 6(a), and the simulated frequency response for the circuit in Figure 8(a).

### First full paragraph of page 6:

In Figure 4, which shows an equivalent circuit of the circuit in Figure 2, the longer segment 220 is represented by an ideal transmission line **420**, and the shorter segment [430] 230 by another ideal transmission line **430**. $V_1$ and $V_2$ are the voltages from node 1 (**440**) and node 2 (**450**) to the ground, respectively. Because the electrical length of the transmission line 230 is nearly zero, $V_1 \approx V_2$ and $I_{S1} \approx I_{S2}$. The output current, $I'_2$, is therefore

$$
\begin{aligned}
I'_2 &= I_{S2} + I_{L2} \\
&\approx I_{S1} + I_{L2} \\
&= I'_1 - I_{L1} + I_{L2} \\
&= I'_1 - (I_{L1} - I_{L2}) \qquad (2)
\end{aligned}
$$

**First full paragraph of page 7:**

The circuit based on the principles of the invention may be made of a variety of conductive materials formed on a dielectric layer. Suitable conductive materials include metals such as copper or gold, superconductors such as, niobium or niobium-tin, and oxide superconductors, such as YBCO. Any suitable dielectric material may be used. Examples include alumina, [duroid] DUROID (a dielectric), magnesium oxide, sapphire or lanthanum aluminate. Methods of deposition of metals and superconductors on substrates and of fabricating devices are well known in the art, and are similar to the methods used in the semiconductor industry.

**Second full paragraph of page 7:**

Referring to Figures 5(a) and 5(b) and 6(a) and 6(b), a single resonator designed based on the principles of the invention is illustrated (Figures 6(a) and 6(b)) and compared with a single resonator design using patch shunt capacitors (Figures 5(a) and 5(b)). The microstrip filter **500** in Figure 5(a) includes two transmission line segments **510** at the two ends (the input and the output). Between the two segments 510 and separated therefrom by gaps **520** are two conductive patches **530** connected by a zigzag transmission line **540**. The patches 530 primarily function as shunt capacitors, and the transmission line 540 primarily functions as an inductor. In the embodiment shown in Figure 5(a), the substrate has a size of 512 x 256 mils, thickness 20 mils and dielectric constant about 10.

**First full paragraph of page 8:**

Figures 5(b) and 6(b) show, respectively, the simulated frequency response curves of the circuits shown in Figures 5(a) and 6(a). Both responses include a dominant resonant mode

around 2.1 GHz. Where they differ significantly is in the harmonics: The first harmonic for the circuit in Figure 5(a) is higher than 5 GHz, whereas the first harmonic for the circuit shown in Figure 6(a) is around 4.6 GHz. Thus, the circuit using closed conductive loops (i.e. Figure 6(a)) may be an suitable alternative to the circuit using patch shunt capacitors in the frequency range near the first harmonic.

**Third full paragraph of page 8:**

As another example, the circuit shown in Figure 8(a) is otherwise the same as that in Figure 6(a) except that the closed loops 630 are replaced by a pair of open-ended stubs **850** and **860**. The frequency response (Figure 8(b)) of the circuit with the stubs is also significantly different from that shown in Figure 6(b). The circuit shown in Figure 8(a) is essentially the one in Figure 6(a) with only a small gap formed in the otherwise closed loop **830**. In theory, if the two open-end stubs 850 and 860 are perfectly symmetrical and balanced and each open-end has exactly half length of the loop shown in Figure 6(a), the filter may achieve a frequency response similar to that shown in Figure 6(b). However, it is difficult to realize such perfect symmetry in practice, and the spurious response as shown in Figure 8(b) (for example, near 3.3 GHz) would be difficult to avoid.

**First full paragraph of page 9:**

Referring to Figures 9(a), 9(b) and 10(a), 10(b), a microstrip low-pass filter designed based on the principles of the invention is illustrated (Figure 10(a)) and compared with a design using patch shunt capacitors (Figure 9(a)). The filter **1000**, shown in Figure 10(a), includes the closed conductive loops **1020** and **1040**, which substitute, respectively, the conductive patches **920** and **940** in the circuit shown in Figure 9(a). The total surface areas occupied by the closed loop capacitors 1020 and 1040 in Figure 10(a) is over 30 percent smaller than that occupied by the patch capacitors 920 and 940 in Figure 9(a). The transmission lines **1030** in the circuit of the invention differ in shape from those 930 in Figure 9(a), but are approximately the same width and total length.

**First full paragraph of page 10:**

Figure 11 illustrates a shunt capacitor realized by a closed conductive loop in a multilayer structure. In the particular embodiment, the loop **1100** extends into three conductive layers separated by dielectric layers (not shown). A first portion **1120** lies in the lower conductive layer; a second portion **1130** lies in the middle layer, with vertical conductive paths **1140** electrically connecting the two portions. A third portion **1150** lies in the top conductive layer, with another pair of vertical conductive paths **1160** connecting the middle 1130 and upper 1150 portions. This multi[p]layer structure dram[i]ati[a]cally reduces the footprint of the shunt capacitor, In contrast, a patch shunt capacitor in a multilayer configuration would not significantly reduce the footprint of the circuits.

**Paragraph beginning on page 10, line 11 and ending on Page 11, line 1:**

To further illustrate the principles of the invention, a five-pole band-stop filter built on 20 mil thick MGO substrate with YBCO thin-film high-temperature superconductor is shown in Figure 12. The filter **1200** includes a transmission line **1210** that includes four serially connected swirl transmission line portions **1240A, 1240B, 1240C** and **1240D**. The input and output ends of the filter 1200, as well as the junctions between the pairs of adjacent transmission line portions **1240**, are connected to their perspective shunt branch resonators **1220A, 1220B, 1220C, 1220D** or **1220E**, which may be identical to each other. Each shunt branch resonator **1220** includes an interdigitized capacitor **1222** in parallel with an inductor **1224**. The parallel combination may also be realized by a frequency-transformed inductor. The resonator is coupled to the transmission line **1210** by a capacitor **1226**. The resonators may be of any suitable configuration. Examples of the components, including interdigitized capacitors and frequency-transformed inductors are disclosed in the U.S. patent applications serial numbers 08/706974, 09/040578 and 09/699783, which are incorporated herein by reference.

**First full paragraph of page 11:**

The input and output ends of the filter 1200, as well as at the junctions between pairs of adjacent inductors 1240, arè also connected to their respective shunt capacitors **1230A,** **1230B,** **1230C,** **1230D** and **1230E**, which are realized by closed conductive loops of varying sizes.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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## CLAIM AMENDMENTS—MARK-UP

4. (Amended) The circuit as set forth in claim 3, wherein the length of one of the two segments is larger than the length of the other of the two segments.

7. (Amended) The circuit as set forth in claim 5, wherein the closed conductive loop is [made] comprised of a superconductor.

10. (Amended) The circuit as set forth in claim 9, wherein the dielectric material is one of magnesium oxide, sapphire [or] and lanthanum aluminate.

14. (Amended) The filter as set forth in claim 13, wherein the transmission line portions and capacitors comprise conductive patterns [formed] disposed on a layer of a dielectric material.

15. (Amended) The filter as set forth in claim 14, wherein the conductive patterns are [made] comprised of a superconductor.

16. (Amended) The filter as set forth in claim 15, wherein the superconductor comprises YBCO and the dielectric material is one of magnesium oxide, sapphire [or] and lanthanum aluminate.